Renewable Energy

at

Five Springs Farm

Make Hay While the Sun Shines

Overview of the Program

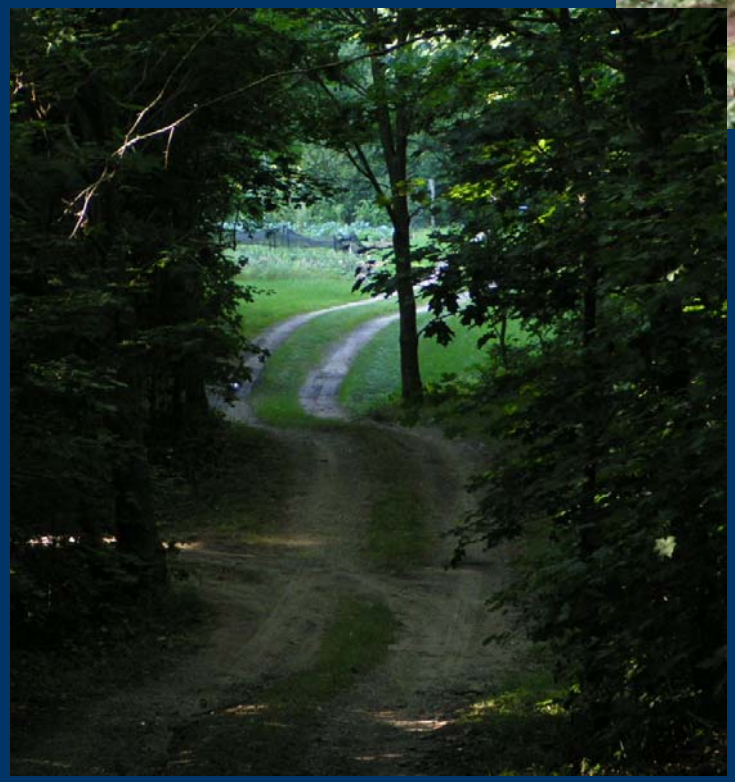
- Short tour of Five Springs Farm
- Short bit about community supported agriculture
- Our system – solar and wind
- Components of a solar and wind system
- Renewable energy options
- What will work with these systems? What won't?
- Some rough guidelines on cost
- Resources - handout
- Questions

Farm Tour

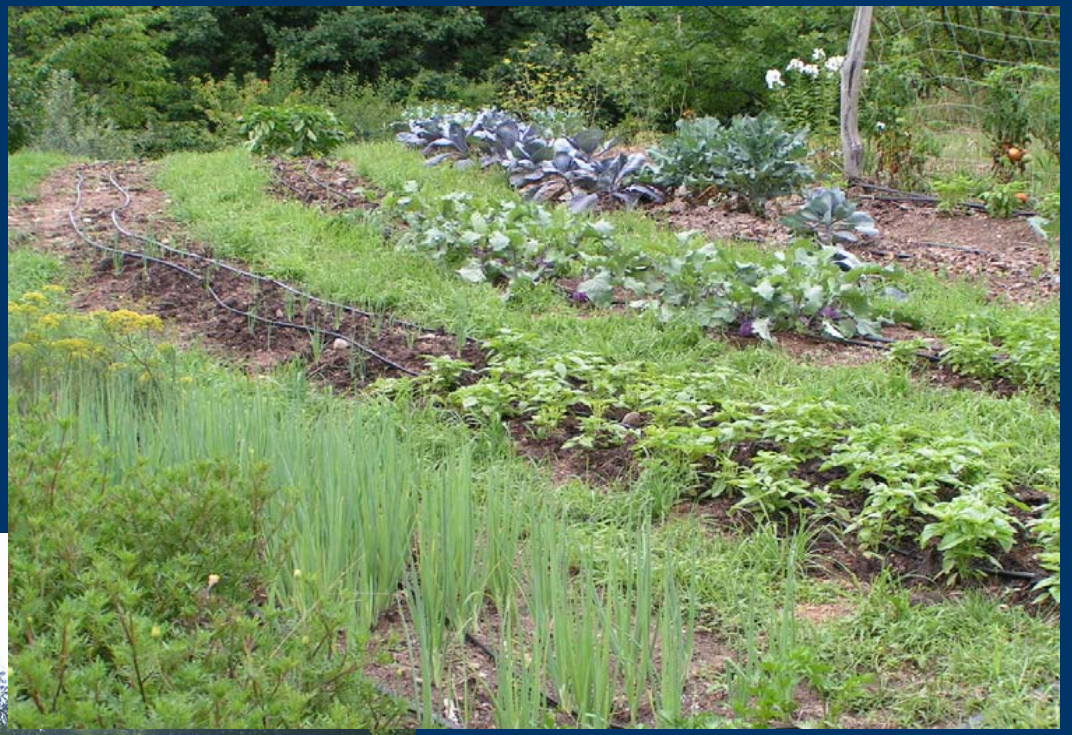
Five Springs Farm

- *Community Supported Agriculture since 1994*
- *18 acres, much hilly and wooded*
- *~1/2 acre under cultivation - Intensive cultivation, raised beds*
- *Up to 30 shares, + some wholesale*

The “Road Fields” are the first gardens you see



More gardens



CSA means diversity...

...and Community...

RE Benefits – and drawbacks

Some Benefits

Reliable and renewable
Fuel is Free
Clean and non-polluting
Available technology
Decentralized
You are in Control (no longer at the mercy of the power company)

Some Downsides

You are in control (service)
Expensive

Renewable Energy at Five Springs Farm

Solar and...

…wind

A Small System at...

- About 425 watts of solar

- A 500 watt wind turbine

SOLAR

- Expensive
- Cloudy days
- Some availability problems

- No moving parts
- Quiet
- 'steady'

Need:

Southern Exposure with
no obstructions from around 9 am to 3 pm

WIND

- moving parts – potential for breakage, maintenance
- Calm days
- Tall tower
- 'fickle'

- Less expensive per watt
- Often windy when it is cloudy

Need:
Windy spot!
Turbine 15-30 feet above anything within 300-500 feet

Renewable Energy Options

Off the grid...like Five Springs Farm

- Independent
- No power outages
- No electric bills
- Expensive
- Need storage - batteries

Interconnected with the grid

- Electric company 'backup'
- Can be 'batteryless'
- May be paid for excess energy production

More Options

A little or a lot

And Yet More Options

DC

12 volt or higher voltage

- More efficient
- 12 volt equipment from RV and boating industry
- Appliances are more expensive

AC inverter

- **'conventional' appearance and appliances**
- **Less efficient**

OR...Both

Both AC and DC at Five Springs Farm

12 volt DC

- **Lights**
- **Water pumps**
- **Compost Tea aerator**
- **Some radios**
- **Refrigerator**
- **Freezer**

AC

- Power tools (drills, saws, etc)
- Greenhouse vent fan
- TV, VCR
- Washing machine
- Stereo
- Computer (laptop)

What Can RE Systems Run?

ALMOST ANYTHING

Easy Loads: efficiency is valuable
lighting
electronics

Bigger loads: efficiency is important
motors
pumps

Difficult loads: efficiency is critical
refrigeration
large motors

Essentially impossible
resistive heating:

- space heater
- electric water heater
- electric range

Components of a RE system

The essentials of an off-grid system

Power source

storage

controller

For AC Loads

'Modified' sine wave

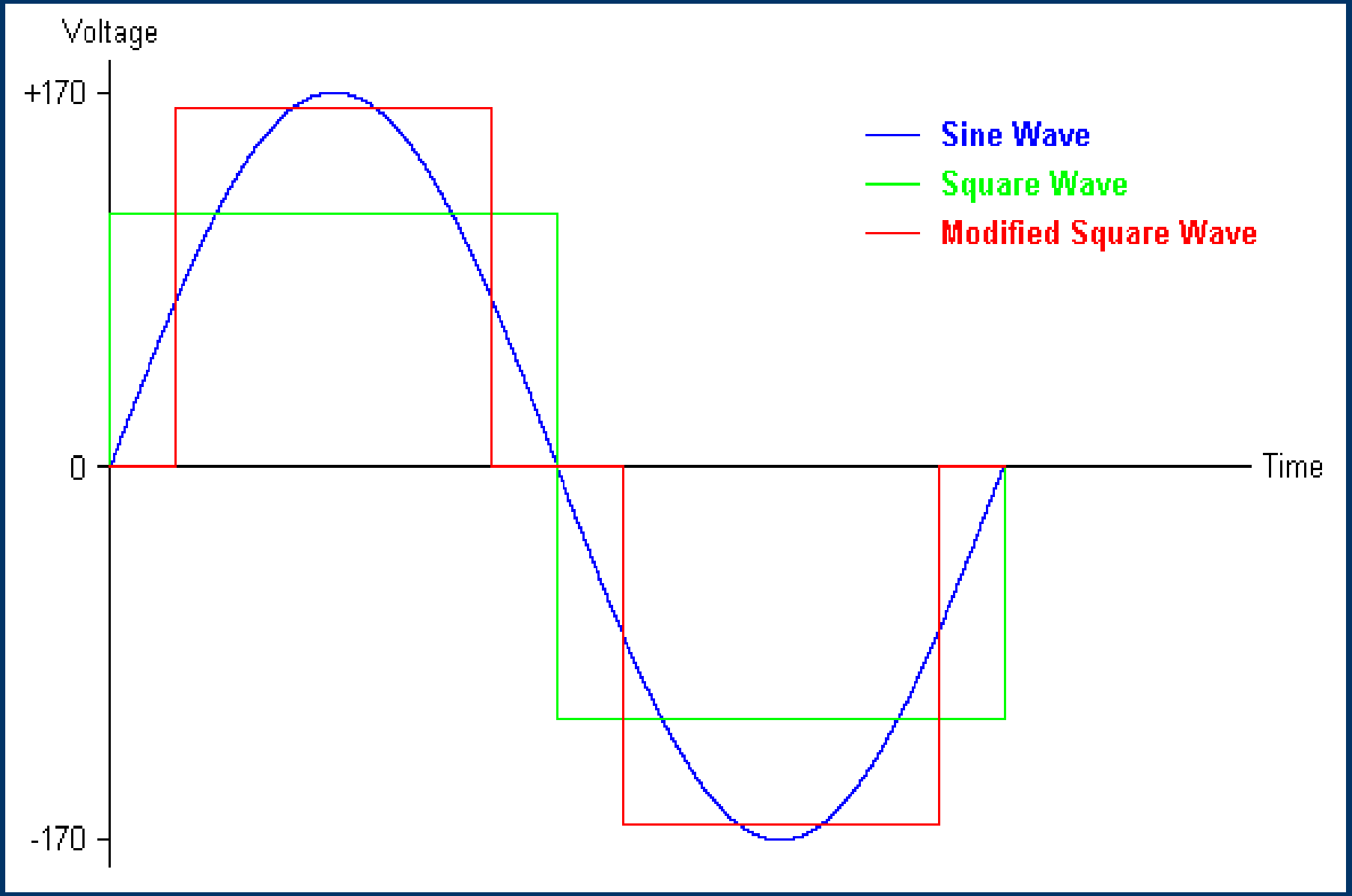
- Efficient
- Reliable
- Work with most loads
- Inexpensive

Sine Wave

- Less efficient (slightly)
- Expensive
- Reliable
- *Any* load, and better for motors and sensitive electronics

Rapidly becoming the industry standard

Wave forms of inverters



Metering

Analog meters:
useful but not adequate

System Monitor:

- Battery voltage
- Net amps
- Amp hour counter
- And more

Our system runs the farm...

And the Household

Some things look conventional

Others are a bit odd...

Conservation is the Key

First step to renewable energy is to reduce electrical needs!

Lighting: change bulbs to compact florescent
Refrigeration: look for very best efficiency
Appliance choices: energy star
Habits and life style:

- Turn off lights
- Don't run extra water
- Look for 'phantom loads' and eliminate

Every $ spent on conservation saves $3-$5 on system costs!!

The Cleanest kilowatt hour – and cheapest – is the one never used

COSTS - Solar

Solar:	cost per installed watt
<1,000 watt -	$11-$13
1,000-4,000 watt:	$8-$10
5,000 +	$6-$8

Our solar system, purchased today:
425 watts solar - $2500 to$2800
Roof Mounts - $100 +
Inverter - $1,000 (x2 for sine wave)
Charge Control - $100 (can spend up to $500+)
Batteries – 8 golf cart, ~$600
Misc - $500 (can be much more!)

TOTAL $4800 +

Wind:

Generator $2000+

Tower: more than you expect

High Energy-Use Alternatives

- **Heating:** wood or gas; boilers can work; avoid electric heaters of any kind
- **Cooking**: gas; watch for 'glow plug' igniter
- **Clothes Drier**: gas or clothesline (solar)
- **Air Conditioning**: fans, shade
- **Refrigeration**: gas

Maintenance

Solar – very little

Tilt panels seasonally -optional

Check output of panels (if suspicious)

Check controllers and other equipment

Wind

Listen for problems/noises

Check guy wires periodically

Check and tighten bolts annually

Batteries

Check monthly – electrolyte and connections

- “Equalize” batteries
- Replace batteries as needed

Some things we do...around the house

Laptop computer

Root cellar

Solar Oven

...and farm

Drip irrigation

manual salad green spinner

'root cellar' cooling

We also gather up to 100 gallons of rain water for general use

Making Hay while the Sun Shines

When the sun is out (or the wind blows strong) we:

- do a load of wash...then another
- vacuum the floors
- Irrigate
- Use power tools

Challenges

Ice and snow

- Cloudy but dry times in summer (irrigation)

- November and December

Michigan Energy Fair!

June 22-24, 2007

Manistee County Fairgrounds

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